Abstract prepared for

45th Annual Meeting of the American Physical Society Division of Plasma Physics

October 27-31, 2003
Albuquerque, New Mexico

RF Plasma Source for Heavy Ion Fusion*

G. Westenskow, D. Grote, R. Hall, LLNL
J. Kapica, J. Kwan, W. Waldron, LBNL

We are developing high-current ion sources for Heavy Ion Fusion (HIF) applications. Heavy ion driven inertial fusion requires beams of high brightness to deposit the necessary high energy in the target to obtain high gain. Our proposed RF plasma source starts with an array of high current density mini-beamlets (of a few mA each at ~100 mA/cm^2) that are kept separated from each other within a set of acceleration grids in order to minimize the space charge expansion. After they have gained sufficient kinetic energy (>1.2 MeV), the mini-beamlets will be allowed to merge together to form a high current beam (about 0.5 A) with low emittance.

We are performing experiments on RF plasma sources. A 80-kV 20-_s source has produced up to 5 mA of Ar^+ in a single beamlet. We have measured the emittance of a beamlet, and the fraction of Ar^{++} ions. The plasma chamber has 26-cm inner diameter with multicusp permanent magnets to confine plasma. RF power (~11 MHz, >10 kW) is applied to the source via a 2-turn, 11-cm diameter antenna inside the chamber. We have started testing a 80-kV 61-hole multi-beamlet array designed to produce a total current >200 mA. In this stage of the experiments the beamlets will not be merged into a single beam. A 500-kV experiment where the beamlets will be merged to a produce 0.5 A beam is being planned.

---

*This work has been performed under the auspices of the US DOE by UC-LBNL under contract DE-AC03-76SF00098 and by UC-LLNL under contract W-7405-ENG-48, for the Heavy Ion Fusion Virtual National Laboratory.